



**Washington State Department of Ecology**

**Economic Analysis of a  
Cap and Trade Program**

**Task 4:** Analysis of Options for Limiting  
Market Manipulation

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## EXECUTIVE SUMMARY

The purpose of this paper is to identify potential sources of allowance price distortion and provide system design options that could be used by the State of Washington and/or the Western Climate Initiative (WCI) to assure that an allowance system will encourage cost effective abatement of GHG emissions. This paper first reviews four types of inter-related markets that present conditions under which price distortions can occur. These markets include: 1) Auction markets; 2) Secondary or spot markets; 3) Derivatives markets; and 4) Markets for products or services produced by firms with emission caps. This is followed by a discussion of existing and past allowance systems to explore factors that might have led to price distortions. The final section presents recommendations and policy-relevant conclusions, which are summarized below:

- Auctioning processes should be readily understood by all potential participants, easy for regulators to conduct, and able to generate quick results.
- A “single-round, uniform-price” auction is recommended as it discourages collusion and uniform prices are suited to aid in price discovery and communication of carbon cost to participants.
- Market participation should initially be open to outsiders (e.g. NGOs and speculators), but participation should be evaluated at later dates to ensure outsiders’ actions are benign.
- Quantity limits for allowance auction purchases can be used as a means of preventing market manipulation and protecting inexperienced participants from over-purchasing allowances. Restrictions are unlikely to discourage new entrants.
- To ensure participants take ownership of allowances, the auction process should be completed quickly and efficiently, financial assurances should be required from bidders, appropriate lot sizes for auctioned allowances should be set, and settlement periods should be kept as short as possible.
- Emissions trading activities should be made as publicly transparent as possible, typically at aggregate levels that protect privacy and confidential business information.
- The use of offsets should be determined by weighing the administrative costs with benefits which include: lower compliance costs for regulated firms; additional liquidity in the spot market; additional emissions reductions in sectors not subject to a cap; and discouragement of entities from artificially inflating allowance prices for individual gain.
- A useful tool for promoting market integrity is a well-funded and vigilant oversight or “market monitor” program established at a regional level to ensure broad overview capabilities. The authority should have access to data on: purchases and sales of emission allowances and offsets; emission caps imposed on regulated firms; the line of business of any outsiders; and complete information on any derivatives instruments and transactions. The authority should also be able to void suspicious transactions.

The research underlying this paper also found no compelling evidence that market manipulation through participant collusion or other market “gaming” situations have occurred in existing and past allowance trading systems. Nevertheless, the creation of a market monitor would be a prudent step for WCI, as it was for the Regional Greenhouse Gas Initiative. Such a body is also contemplated in federal GHG legislation.

As the research for this paper was being completed, the U.S entered its worst financial crisis since the Great Depression. Some observers have questioned whether the crash of financial markets should lead policymakers to abandon plans to use cap-and-trade, and the emissions market it entails, to address climate change. However, the financial crisis should not lead the U.S. to abandon emissions markets, any more than it should abandon markets for countless goods and services generated across the economy. Nothing about the financial crisis that has emerged to date would undercut the arguments made in this paper.

Most analysis of the financial crisis points to two key causes: first, a housing bubble that finally burst; and, second, unregulated financial derivatives, especially credit default swaps (which resembled insurance in their function but had no underlying reserves). Economists generally attribute the housing bubble to a combination of private and federal actions that poured money into housing markets, eroded lending standards, and shifted risks of loan defaults away from loan originators. None of these phenomena are present in current emissions markets, nor are they likely in a future mandatory GHG market. Nevertheless, it is instructive to note that the lack appropriate government regulation and oversight could have prevented or at least ameliorated the causes of the financial crisis.

Years ago, some observers labeled financial derivatives as “weapons of financial mass destruction”, but those warnings were not heeded. Similarly, for years some policymakers called for the Commodities Futures Trading Commission (CFTC) to regulate financial derivatives, but those efforts were beaten back. Properly designed and regulated, derivatives are a useful and effectively way for firms to manage risk. Fortunately, the CFTC is already exercising jurisdiction over derivatives in existing SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> markets in the U.S., and parallel agencies in the European Union are doing the same for its emissions markets. In future GHG markets, the CFTC should naturally expand its oversight to include new emissions markets. The Securities and Exchange Commission and the Federal Energy Regulatory Commission are also likely to have roles, along with overall management of the program by the U.S. EPA or which ever agency is deemed the lead. With the exception of EPA, these federal agencies would play similar roles in a regional GHG trading market. EPA’s role would transfer to state environmental agencies and regional bodies. Cooperation among all agencies would enhance the transparent and competitive operation of the market.

# 1 INTRODUCTION

The case for including emissions trading in an environmental policy designed to address greenhouse gas (GHG) emissions is based on the cost savings that might be realized relative to a more conventional command and control approach to regulating emissions. Specifically, because emissions trading creates economic incentives that encourage entities with low cost abatement options to undertake a larger share of the burden of reducing emissions, the total cost of meeting a given target across all covered entities could be lower than if each entity was required to satisfy an emissions target on its own.<sup>1</sup> In an ideal world, emissions trading would assure that the cost of reducing the last ton of emissions needed to satisfy an emissions target would equal the price of a tradable allowance.

The world, however, is rarely ideal and a variety of actions on the part of entities that participate in the market for allowances could interfere with achieving this outcome. For example, if two or more allowance market participants decide to collude, they might be able to distort the price of allowances to their advantage. Allowance prices might also be distorted as an unintended result of risk aversion on the part of firms with emission caps and/or as a result of mistakes by either buyers or sellers. Whether the result of intentional manipulation or the outcome of other forces at play in the market, distortions in allowance prices will reduce the efficiency of an emissions trading system and could have serious adverse affects on participants in allowance markets.

The purpose of this paper is to identify potential sources of allowance price distortion and provide system design options that could be used by the State of Washington and/or the Western Climate Initiative (WCI) to assure that an allowance system will encourage cost effective abatement of GHG emissions. Toward this end, the following section examines the various types of markets and participants that could be affected by emissions trading. Of particular interest are the conditions that would be necessary for participant actions to lead to a distortion in an allowance and related markets. Section 3 provides evidence from existing and past trading systems on the presence and scope of price distortions that have been observed in other allowance markets. In Section 4, system design options that could be implemented to address the different sources of allowance price distortions are identified and discussed.

## 2 MARKETS AND PARTICIPANTS: MOTIVES AND OPPORTUNITIES

From a purely theoretical perspective a trading system might present opportunities for entities to take actions that could distort the prices of allowances and even goods and services that are sold by firms subject to emission caps. To minimize the potential for creating conditions under which price distortions could occur from emissions trading, system designers need to consider four types of inter-related markets. These include, allowance auction markets, secondary or spot markets for allowances, markets for derivatives based on allowances, and markets for products and services produced by firms with emission caps. The following focuses on the first three of these markets however, a discussion of some potential problems with product and services markets are introduced in a short piece at the end of this section.

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<sup>1</sup> Add caveat that administrative and transaction costs must also be considered in determining the overall cost of emissions trading.

## 2.1 Auction Markets

The most controversial aspect of any trading system tends to be the approach taken to the distribution of allowances. If allowances are allocated free of charge to firms with emission caps, issues arise related to the basis for the allocation. That is, controversy tends to surround whether the allocations are based on historical emissions, projected emissions, emissions intensity, or some other approach. In addition, because firms receiving allowances internalize the opportunity costs and pass them along to customers, they end up earning windfall profits because they did not have to purchase the allowances. This particular aspect of trading systems that allocate allowances has come under increasing criticism of late leading system designers to consider auctioning of allowance as a preferred method of distribution (Burtraw, 2008).

In addition to eliminating the windfall profits associated with allocation, auctioning of allowances offers a number of other benefits including:

- Freeing regulators from having to devise a scheme for distributing allowance to each firm covered by the emissions trading system (this is only true in systems where 100% of allowances are distributed through an auctioning process);
- Generating revenues that can be used to offset the cost of administering the trading system and promote other objectives such as funding research and development, investing in energy efficiency technologies, or reducing the burden on consumers; and
- Providing an early price signal for allowances.

Critics of auctioning point to a variety of issues that might surface and which depend primarily on how the auction is designed. Auction features that could influence the potential for allowance price distortions include:

- The type of auction—e.g., single vs. multiple round, and uniform vs. discriminatory price;
- Who is allowed to participate in the auction—e.g., will it be limited to firms facing emission caps or will others be allowed to submit bids;
- The quantity of allowances that a single entity is allowed to purchase at any given auction; and
- Additional rules such as those covering deposits, defaults, reserve prices, and settlement periods.

The implications of each of these for creating conditions under which allowance prices could be distorted are discussed below.

### 2.1.1 Auction Types

While variations in how auctions are conducted are common, there are basically four types of auctions that are used when multiple units of an item are being sold. These auction types are characterized by decisions auction organizers make about two features: the number of rounds of bidding and whether winning bidders all pay the same—i.e. a uniform—price for each item that is sold (see Figure 1). The most widely recognized example of a single-round, uniform-price auction is likely the T-bill auction that is routinely conducted by the US Treasury. The US EPA's SO<sub>2</sub> allowance auction is an example of a single-round, discriminatory auction in which successful bidders pay the prices they bid. These and other auction examples are discussed further in Appendix A.

Issues that should be considered in selecting the type of auction to use include:

- Price discovery—i.e., the potential for the auction to reveal the true market value of the auctioned item.
- Simplicity—i.e., the auction mechanism needs to be fully understood by bidders.
- Revenue generation—different auction designs have different implications for the revenues that will be collected from the sale of auctioned items.
- Collusion—i.e., the potential for bidders to coordinate their strategies to depress the price of the auctioned items.
- Monopoly behavior—i.e. the potential for a single large buyer to underbid in order to depress the price of the items being sold.
- Winner's curse—i.e., the situation in which the price(s) successful bidders pay is significantly higher than the true value of the item.

Each of the four types of auctions has different implications for this set of issues.

**Figure 1: Types of Auctions**

Prices	
Rounds	<p><u><b>Type 1</b></u></p> <p>Single round</p> <p>Uniform price</p> <p>Ex: T-bill auctions</p>
	<p><u><b>Type 2</b></u></p> <p>Single round</p> <p>Discriminatory price</p> <p>Ex: SO<sub>2</sub> Allowances</p>
Rounds	<p><u><b>Type 3</b></u></p> <p>Multiple round</p> <p>Uniform price</p> <p>Ex: Lithuania's CO<sub>2</sub> auction under Phase I EU ETS</p>
	<p><u><b>Type 4</b></u></p> <p>Multiple round</p> <p>Discriminatory prices</p> <p>Ex: Dutch flower auctions</p>

**Type 1 Auctions: Single-round, Uniform-price:** In these types of auctions, potential buyers submit their one time bids in the form of price-quantity combinations (Cramton and Kerr, 1998). Once the price is established, all successful bidders pay the same price for each unit of allowances purchased. Advantages of the Type 1 auction include its simplicity and its effectiveness at inhibiting collusion and possibly monopolistic behavior on the part of a single large bidder. The simplicity of this type of auction means that the administrative burden on the regulator is low. In addition, its simplicity tends to encourage greater participation among potential buyers, which makes it much more unlikely that a single large buyer will be able to manipulate the price. Because they cannot



observe each other's actions, the single round feature of Type 1 auctions also makes it difficult for two or more bidders to collaborate to manipulate the price.

Disadvantages of Type 1 auctions include potential difficulties in price discovery and an increased likelihood that successful bidders will suffer from the "winner's curse." In addition, since all successful bidders pay the same price, as opposed to the maximum price they are willing to pay, the revenues generated under these types of auctions tend to be lower than in auctions that employ discriminatory pricing.

*Type 2 Auctions: Single-round, discriminatory-price.* This is the type of auction that is used to distribute SO<sub>2</sub> allowances under the US Acid Rain Program (EPA, 2008). Potential buyers submit their price-quantity bids and once the number of allowances offered for sale is exhausted, each buyer pays the fully bid price they submitted in their bid. The advantages and disadvantages of Type 2 auctions are similar to those of Type 1 with the notable exception that the revenues accruing to the regulator could be substantially higher. In addition, the loss associated with the "winner's curse" can also be much higher under Type 2 auctions.

*Type 3 Auctions: Multiple-round, uniform-price.* In multiple-round, uniform-price auctions, bidders are allowed to adjust their price quantity combinations during successive rounds of bidding. The price is determined when all of the items offered for sale are sold and all participants in the auction pay this final price. A key advantage of Type 3 auctions is in its ability to facilitate effective price discovery. By allowing participants to adjust their bids in successive rounds in response to information obtained during the auction, the true value of an auctioned item is revealed. The information available to participants during multiple-round auctions can put them at risk from manipulation by colluding participants. However, collusion is generally only successful when there are a small number of bidders. The more bidders there are participating in the auction, the more difficult it becomes to coordinate bidding strategies and the less likely it is that collusion will be successful at distorting the final price (Hepburn, et.al, 2006).

*Type 4 Auctions: Multiple-round, discriminatory-price.* The difference between Type 4 and Type 3 auctions is that under Type 4 auctions buyers are allowed to purchase their desired quantity at any point during the auction. This so-called "buy it now" feature means that different buyers could pay different prices for blocks of allowances. This feature can be appealing to buyers that are concerned about being blocked out from obtaining all of the allowances they want if they wait until the equilibrium price is achieved. One advantage of the Type 4 auction is that it tends to be very fast, which reduces the costs to the regulator for running the auction. Another advantage of Type 4 over single price auctions is that they can generate higher revenues for the regulator (Cramton and Kerr, 1998). Type 4 auctions have the same implications for market manipulation as Type 3 auctions. Specifically, if there are many bidders participating in the auction, manipulation is difficult to coordinate and the opportunity for collusive behavior to be successful is reduced. An important disadvantage of the multiple-rounds, discriminatory-price auction is that inexperienced buyers are more likely to make mistakes and pay too much for allowances and, because it is a relatively rare type of auction, inexperienced buyers might be reluctant to participate, which could have adverse implications for price discovery and market manipulation.

### **2.1.2 Participation in Auction Markets**

One concern often expressed by firms anticipating caps under an emissions trading system is the potential for "outsiders"—i.e., entities that are not subject to emission caps—to disrupt the market for emission allowances by purchasing allowances for which they have no immediate use. Speculators, NGOs that want to purchase and retire allowances, entities that anticipate future carbon caps, and firms or individuals acting as buyers' agents are among the potential "outsiders" that might have an interest in purchasing allowances during auctions. To the extent that these and

other groups and individuals participate in the auction markets, their actions will tend to increase the price of allowances. Groups and firms that have expressed concern over the potential price effects of allowing non-covered entities to participate in allowance auctions strongly support closed auctions (AOI, 2008)

Those who favor allowing the participation of non-covered entities in auction markets argue that the involvement of professional traders and investors is most likely to have a stabilizing impact on the market. For example, speculators are most likely to enter markets when prices are below their projections of long run prices and they exit markets once prices have increased to levels that are consistent with their long range forecasts. This activity tends to reduce price volatility, align short and long term prices, and improve the functioning of the market (Holt, et al, 2007).

Neither economic theory nor empirical evidence is clear on whether or not speculation is stabilizing. Some very prominent economists have argued that in the presence of uncertainty, profitable, destabilizing speculation<sup>2</sup> is possible, which suggests that speculators might have an incentive to disrupt markets in some circumstances (Guth, 2007). Since the potential for third parties to create distortions in allowance prices cannot be ruled out, one of the recommendations in the final section of this report is that their activities be closely monitored to ensure their actions are benign.

Another set of “outsiders” whose activities bear watching are entities that act as agents for firms that are subject to emissions caps. To the extent that buyer’s agents could be unscrupulous collaborators or unwitting pawns in a scheme to exercise market power, requiring agents to reveal their client(s) would diminish the agent’s ability to contribute to a buyer’s objective. In addition to obtaining information on the party or parties agents are representing, authorities need to have clear records detailing the scale of any transactions an agent makes on behalf of all of its clients. Whether and how much of this information should be released to the public is a matter that is discussed below in Section 2.4.

### **2.1.3 Quantity Limits**

Restricting the number of allowances a single buyer can obtain during a given auction has been suggested as one means of reducing the chances of market manipulation by making it more time consuming if not more difficult for an entity to establish a significant position in the market (Holt, et al, 2007). The percentage of allowances to be allocated instead of auctioned is still under consideration. To the extent that a significant share of allowances is allocated, it would be difficult for any entity to capture, via the auctions, a sufficiently large position in the allowance market to permit market manipulation.

One factor to consider before placing a quantity restriction on auction transactions is how this might impact firms that are trying to enter carbon constrained markets—i.e., new entrants. Since they are not eligible for an allocation of allowances, new entrants typically have to depend on auction as well as spot markets for access to the allowances they will need to begin operation. However, given the size of the WCI market and the fact that quarterly auctions are planned, limiting access to allowances during any single auction might present more of an apparent than a real obstacle to entry. Some additional consideration of the potential for creating a barrier to entry would be beneficial prior to making a decision on restricting purchases during auctions.

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<sup>2</sup> For example, if there is a great deal of uncertainty about the true value of an allowance, speculators might be able to enter the market when prices are rising and start bidding up prices even higher. If other entities, especially ones that anticipate needing to purchase allowances, become concerned about how high prices could go, they might also enter the market on the buyer’s side, giving speculators the opportunity to sell allowances they purchased early on for more than they originally paid. This type of activity on the part of speculators carries a very high risk of failure and is unlikely to be a major motive for participation in an allowance market. However, it cannot be ruled out completely.

Beyond entry and market manipulation motives, additional and possibly more realistic reasons that entities might want to make large purchases during auctions are related to mistakes on the part of inexperienced buyers and risk aversion on the part of entities that are concerned about their ability to comply with emission caps. Limiting the quantity of allowances that an entity can purchase could be helpful to the first group. It is not clear how the second group would fare if purchases are constrained. However, access to secondary (spot) market transactions and the potential of participating in quarterly auctions will minimize adverse impacts on risk averse entities.

#### **2.1.4 Auction Rules**

In designing allowance auctions regulators need to consider the very important details of auction rules. Details such as requiring deposits or financial assurances from participants could be important in preventing bidders from manipulating the market. In 1993, the Australian government conducted a license auction for satellite TV stations. The auction was a sealed-bid format but the Australian government did not impose any default penalties or require a deposit from bidders that were participating in the auction. The Australian regulators also allowed participants to make multiple bids. As a result, the winner intentionally bid at high price to secure the license but subsequently defaulted their winning bid forcing the regulator to award the license to lower bids. Tellingly, the same company was next in line to receive the license – thus, the company that originally won the license by bidding at the highest price was able to pay significantly less through a series of defaults and the company ended up selling its license to another party at a huge profit.

During its Phase I EU ETS auction, Ireland found the required deposit and settlement period were two very important factors to provide disincentives for bidders defaulting on their bids. Ireland conducted two auctions during Phase I. For the first auction, bids required a €3,000 deposit, which was increased to €15,000 in the second auction to ensure bidders would not default on their bids. In addition, the settlement period was five days for the first auction; this was reduced to two days in the second auction. This shortening of the settlement period was implemented to reduce changes in allowance prices on the secondary market.

Another issue that allowance trading system designers need to consider in selecting auction formats and bidding rules is the implications these might have for participation by small bidders. Different auctions have attempted to allow small bidders to enter the market by having small lot sizes (e.g., allowing bidders to bid on small volumes of allowances) or by capping the amount of allowances that any one bidder can win (e.g., one bidder can only purchase 20 percent of the auctioned allowances). There is a trade-off, however, between encouraging small bidders to enter the auction and discouraging large bidders. If the lot size is too small or the cap is too restrictive then large bidders (who effectively drive the auction) might estimate that they cannot generate enough cost savings from purchasing allowances to cover the fixed costs that would be required for pollution abatement. WCI should carefully examine the characteristics of potential bidders and try to come up with a sensible lot size or cap.

## **2.2 Secondary or Spot Markets for Allowances**

Most transactions in emission allowances are likely to take place in the secondary or spot market. Spot market trade can involve either transactions conducted through organized exchanges or bilateral transactions carried out directly between a buyer and a seller. What characterizes spot market transactions is the immediate exchange of the payment and ownership of the traded allowances. Exchanges that currently handle allowance trades include the Chicago Climate Exchange, the European Climate Exchange, Nord Pool, PowerNext, Multi-Commodity Exchange, the National Commodity and Derivatives Exchange.

### Thinly Traded Markets

In a well functioning spot market, prices will tend to be relatively stable in the short run and exhibit gradual movement over time depending on conditions giving rise to changes in supply and demand. One possible concern with regard to spot markets in emission allowances is the extent to which trading activity will be sufficiently robust to ensure this relative price stability. In thinly traded markets, prices can fluctuate strongly leading to confusing and/or inappropriate price signals and increase the perceived, if not the actual, risks to buyers and sellers.

Thin trading in spot markets for allowances could be related to a number of market conditions including emission caps that are too generous, which would mean that trading is not necessary for most entities, or because of risk aversion on the part of covered entities with surplus allowances. Trading system features that tend to discourage hoarding due to risk aversion include more frequent auctions and longer compliance periods, both of which have already been incorporated into current WCI plans. Another approach to reducing hoarding is to set a limit on the quantity of surplus allowances entities are allowed to hold in excess of their cap. While this measure would decrease hoarding, such an approach would not address the underlying cause (i.e., risk aversion) and could drive some firms to seek more opaque methods of assuring access to allowances. In addition, it is likely to be difficult to distinguish between cases where risk aversion is driving behavior and cases where an entity's realistic expectations of future requirements are driving their decisions.

### Transparency

One system feature that would discourage attempts to manipulate the spot market for WCI emission allowances is to require the immediate transmission of all pertinent information about every transaction to the emissions registry. Required information would include the size of the transaction (how many allowances changed hands), the price paid per allowance, and, if buyer or seller agents are participating in the market, the ultimate owner of the allowances purchased and sold. The main benefit from this information transmission is in the transparency it offers. In general, the more transparency there is in emissions trading markets, the more difficult it becomes for one or more entities to create a position from which they can exercise market power.<sup>3</sup>

Note that WCI might also want to consider adding a provision that permits an oversight body to void any transactions that appear improper and claim the allowances at the current spot market price or the transaction price, whichever is lower.

### Interactions Between Spot and Auction Markets

If the spot market for allowance is robust, prices obtained for allowances during auctions are likely to be very close to the prevailing price in the spot market. However, if the spot market is thinly traded and/or the auctioning process is not concluded quickly, a divergence between prices paid at auction and prices in spot market transactions could result. To avoid this source of price distortion, the design of the auction system should take into account how quickly results from the auction can be finalized. The shorter the length of time between the start of the auction and finalization of auction transactions, the less disruption there will be in the spot market.

### Offsets

Emission reduction offsets based on project level activities in sectors or regions that are not covered by the trading regime are often included in carbon trading systems to give covered firms opportunities to obtain carbon instruments at costs that are lower than the cost of internal options. Offset provisions, such as those contemplated by WCI, can have an important stabilizing affect on

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<sup>3</sup> There could be a trade-off between the use of information in ensuring competitive allowance markets and creating conditions that are conducive to collusion in product and services markets. See Section 2.4 for more on this.

spot markets, especially in the presence of hoarding that leads to thinly traded markets. The availability of offsets can also help dissuade market participants from attempting to manipulate price increases that might allow them to obtain profits based on non-competitive activities.

## **2.3 Derivative Markets**

Derivatives are a type of financial instrument or contract whose prices are derived from one or more underlying assets such as stocks, bonds, currencies, and in the case of carbon markets, emission allowances or offset credits. Derivatives are exchanged in over-the-counter transactions—i.e., direct trades between two parties—as well as on exchange platforms. Derivatives are typically used for risk management. Buyers and sellers use derivative instruments to “lock-in” prices and quantities of the underlying assets that will be exchanged at a future date. Options, futures, forwards, and swaps are all examples of derivatives.

In carbon markets, the most common types of derivative instruments are futures and options. Active derivative markets currently exist for Certified Emission Reductions (CERs), which are the credits associated with Clean Development Mechanism projects, European Union Allowances, the currency of the EU Emissions Trading Scheme, SO<sub>2</sub> and NO<sub>x</sub> allowances, and RGGI credits. Derivatives based on these instruments are currently sold on several exchanges around the world including the Chicago Futures Exchange, NYMEX’s Green Exchange, and the European Union Climate Exchange.

Derivative trades tend to involve complex contracts that are often poorly understood by buyers and sellers whose primary line of business is something other than financial trading. These two features of derivative trading give rise to concerns over the potential for market manipulation. At the national level, oversight of exchange based trading (but not over-the-counter transactions) in futures is the responsibility of the Commodity Futures Trading Commission (CFTC). The Federal Energy Regulatory Commission (FERC) also has some oversight responsibilities as these related to derivatives based on energy markets. In addition, if legislation introduced by Senators Feinstein and Snowe in December of 2007 is passed, the US Environmental Protection Agency (EPA) will also be tasked with some oversight of emissions trading markets including those involving trade in derivatives. What is not clear at present is whether the existing legislation and proposed legislation is adequate to ensure that manipulation of the carbon market is not possible. A particularly serious gap in Federal statutes is that it is unclear as to whether or not they apply to emissions trading systems created by states.

Oversight of all trading activity that involves WCI emission allowances is something that the WCI Partners need to consider carefully. One of the conditions that allowed Enron’s manipulation of California’s energy markets in 2000 and 2001 was a gap in oversight coverage at the Federal level. A well funded and well staffed oversight group is the best option that WCI Partners have to ensure that derivative trading practices and instruments are legitimate approaches to reducing risks and not tools that could be used for market manipulation.



## 2.4 Markets for Products and Services

Although the focus of this paper is on potential distortions in allowance markets, a few issues related to emissions trading and product markets are worth noting here. These issues should be the subject of further investigation before any conclusion can be drawn as to whether inter-connections between allowance markets and product markets could create conditions that are conducive to the manipulation of markets for products and services.

One of the often voiced concerns about carbon constraints in the United States is whether they could create conditions that firms could exploit to manipulate the price at which they sell their product or service. References are often made to Enron and that firm's contribution to the energy crisis in California during 2000 and 2001 (Jinckling, 2008). Enron and some other firms with electricity generation assets in the state exploited two features of California's

legislation that was put into place during the late 1990s when California initiated deregulation of its energy market (See Figure 2). The Enron example raises an interesting question about the relationship between the structure of an emission trading system and the legal framework in which firms in WCI Partners operate. This is an area where further research could prove useful. Legal experts could help identify existing regulations applicable to firms that will be subject to emission caps; and economists could assess those regulations with a view toward developing a better understanding how existing constraints could interact with a cap and trade system.

Enron's manipulation of the California electricity market has left a legacy of concern over future corrupt practices in energy markets as well as questions about how the electricity market might interact with an allowance market. There are many differences between the two markets that inhibit Enron-like manipulations that occurred in the electricity market from occurring in the allowance market. Electricity is a non-storable commodity that needs to flow through transmission lines in a way that assures supply and demand are kept in balance and that avoids voltage and frequency fluctuations. Changes in weather, economic activity, consumer demand, and fuel prices can all affect the supply of and demand for electricity. Electric generators need to respond immediately to these influences to ensure the stability of the grid.

Allowance markets do not face the same types of challenges that confront the electricity market. The WCI has proposed a three-year compliance period for sources to cover their emissions. Since sources will have three

### **Enron and the CA Energy Crisis**

Enron contributed to California's energy crisis in 2000 and 2001 by exploiting two features of the regulations that lawmakers imposed on distribution companies in the legislation put in place when the state began partial deregulation of its energy markets. Specifically, California lawmakers capped prices that distribution companies could charge their customers at pre-deregulation levels and at the same time, legislators required distribution companies to purchase electricity in uncapped spot markets during periods of high demand when shortages appeared likely. Enron and other energy suppliers (e.g., Reliant Energy) in the state that owned generation facilities were able to manipulate electricity prices by creating shortages that forced distribution companies to pay high spot market prices for the electricity that they had to sell to customers at much lower prices.

The California energy crisis and Enron's role in creating that crisis point clearly to the need for careful consideration of the implications of regulations affecting markets in which firms receiving carbon caps will operate.

### **Federal Regulation**

There are currently on-going discussions on how to prevent future market disruptions in the electricity market. On June 3, 2008, the U.S. Senate Committee on Commerce, Science, and Transportation held hearings on "energy market manipulation and federal enforcement regimes," which addressed the lack of regulation by the Commodity Futures Trading Commission of over the counter trading in energy futures, which created what is known as the "Enron-Loophole".

years to true-up their actual emissions, this will reduce the possibility that short-term spikes in electricity demand will have a significant influence on the price of allowances. In addition, the ability to bank allowances will reduce the effectiveness of strategic hoarding behavior since the presence of a substantial privately held bank of allowances will make it extremely expensive for a source to manipulate the market. Any attempt to raise the market price will require buying-up allowances that have been banked by a very large number of entities. Banking also reduces the potential of significant increases in allowance prices due to purchases by electricity generators in response to spikes in demand.

The WCI states' proposal to hold quarterly auctions coupled with the fact that allowances can be traded on a secondary market or bilaterally at any time further reduces the risk of allowance price manipulation. Moreover, the WCI market will effectively spread risk across states by incorporating multiple sectors that can further reduce allowance price fluctuations due to energy price spikes and dips associated with weather-related events (e.g. drought) and other production difficulties. While fluctuations in the price of electricity will undoubtedly occur, it is important to remember that the price of an allowance (per ton) is anticipated to be a very small component of the price of electricity (in MWh). Finally, as discussed below, the WCI can design the allowance market with safeguards to limit market manipulation.

A second question related to the potential for product and service market manipulation that should be considered more fully is whether information that could be made public about emissions trading activity could create conditions that would facilitate cartelization in a product market. In particular, because of its close tie to production levels, information on emissions trading activity on the part of individual firms might provide the information needed to enforce a collusive agreement among firms within a product or service industry.<sup>4</sup> Specific issues that need clarification include the degree to which markets in WCI Partners exhibit a high degree of concentration and the "contestability" or openness of markets in WCI states—i.e., whether new entrants, other domestic, or foreign producers outside of WCI could supply close substitutes for products produced in concentrated industries.

Finally, additional research could be conducted to better understand the implications of contracts or other arrangements that combine emission allowances and products sold by firms within WCI Partners. Bundling of allowances with other inputs could be an indication that a supplier or a buyer is using access to emission allowances to gain a competitive advantage in their market.

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<sup>4</sup> Cartel agreements tend to be "fragile" because participants have a strong incentive to cheat on the agreement. Specifically, cartels seek to restrict output with a view toward increasing the price of the product they sell. If it is not easy for a firm's competitors to determine its actual production level, then it can increase its profits by producing more than the agreed upon level of output and selling it at the higher price. Information about purchases of allowances could provide the kind of information about production levels that members of a cartel need in order to know when others are cheating on the agreement.

### **3 EVIDENCE FROM EXISTING AND PAST ALLOWANCE SYSTEMS**

In examining reports of cap and trade programs such as the Acid Rain (SO<sub>x</sub>) emissions, Ozone Transport Commission's (OTC) NO<sub>x</sub> Budget Programs, The South Coast Air Quality Management District (SCAQMD)'s offset program for reactive organic gases, SCAQMD's RECLAIM program for SO<sub>x</sub> and NO<sub>x</sub>, leaded gasoline credit trading program, and the EU ETS, we have not found compelling evidence that market manipulation through collusion or other market "gaming" situations have occurred. Price distortions have occurred when there is not full price disclosure or when trading has been thin and this has caused some price volatility, however, as these markets became more established these problems diminished. This section summarizes the evidence. A more extensive treatment of the record to date appears in Appendix B.

#### **3.1 Evidence from the EU Emission Trading System**

The EU ETS program has demonstrated that an efficient allowance market requires access to accurate and timely emissions data. A phenomenon seen in many cap-and-trade programs is that without accurate emissions data, companies tend to purchase or hold onto more allowances than they need due to risk aversion. For instance in the spring of 2006, there was a sharp decline in European Union Allowances (EUA) prices for both the trial period, which ran from 2005 through 2007, and second period EUAs, which runs from 2008 through 2012. In April 2006, several member states reported their 2005 emissions, which were significantly less than expected. Within a week, EUA prices fell by 30% to 50%. Uncertainty concerning the demand for allowances is especially large at the beginning of any program because of the usual set of unpredictable variables such as energy prices, weather and economic activity and additionally the uncertainty surrounding the effectiveness of abatement strategies such as fuel switching. In the case of the EU, once inventories were completed, it became clear that most covered entities had over-complied with their caps, which caused the price of allowances to drop dramatically.

Studies of the EU ETS program have also determined that there was an imbalance in the presence of buyers and sellers in the EU allowance market during the first half of the trial period. Ellerman and Joskow found that initially, companies that were short allowances and needed to cover their emissions were disproportionately present in the market and companies that held long positions were not as active. This was the result of an explicit policy decision taken by many EU 15 governments to allocate relatively fewer allowances to the electricity sector than to firms in other industries that are covered by the trading system. The rationale was (a) that electric utilities had more means of abatement available in the short run than did other industries (e.g., switching from coal to gas) and (b) that they did not face international competition with countries outside the EU. The potential sellers of allowances, which were non-power companies in the EU 15 and all companies in Eastern Europe, were largely absent from the market. Ellerman and Joskow argued that companies who were long could take a wait-and-see attitude and many in the EU appear to have taken that approach. In addition, allowance registries, which are needed to deliver allowances to buyers, were not in place in many Eastern European countries. In 2006, the registries were up and running and companies that had extra allowances realized that selling allowances that could not be used in the second period for a low price was better than getting no sales revenue at all. This increase in allowances available also contributed to the sharp decrease in EU allowance prices. As the EU ETS market has become more mature and established, these imbalances have diminished.

#### **3.2 Evidence from the US Acid Rain Program**

There has been some concern that the auctioning of credits will adversely affect the secondary market and that there would be price distortions between the auction prices and the secondary



market. In general, if the auction is well designed and the secondary market is mature, the auction price is expected to closely mirror the price in the secondary market. This convergence also demonstrates that the market is functioning effectively since if there were market manipulations, the prices would diverge. Empirical evidence from previous allowance markets, especially the US Acid Rain Program's SO<sub>2</sub> market indicates that the auction price and spot market price track each other closely. Title IV of the 1990 Clean Air Act Amendments established the SO<sub>2</sub> emissions allowance program and specified that 2.8% of the allowances issued every year should be allocated through a revenue neutral auction. The primary reason the auction was included was to address concerns of independent power producers that new entrants into electricity generation would not have access to allowances if the incumbent generators "hoarded" allowances or for some other reason the secondary market was not liquid. While the concern turned out to be misplaced, as the secondary market has always been liquid, the auction performed two valuable functions in that it forced a redistribution of allowances and thus contributed to price discovery at a time when expectations about compliance costs were varied.

### **3.3 Evidence relating to Other Trading Systems**

World Resources Institute has identified some observations and lessons from the OTC NO<sub>x</sub> Budget Program that could also be useful for the State of Washington. The OTC NO<sub>x</sub> budget had no methods for early price discovery before it went into effect in 1997. In 1998, market participants thought the market was initially short and they did not have the time to install control equipment for the upcoming NO<sub>x</sub> season. By late 1998 average allowances had risen to more than \$5,000 per ton, far above the cost of control for any regulated source. Only a few trades took place among different firms at this time, although it is not clear whether the multiple-state allocation plans contributed to the uncertainty surrounding the availability of allowances, and therefore also the initial price spike. By July 1999, prices had fallen back to the predicted level and several factors accounted for the decline. First, early reduction allowances began to enter the market, which increased the supply of allowances and secondly, firms found that when they were given incentives, they could install additional emissions control equipment more quickly. As trading became more common, prices became less volatile and while a few firms faced higher costs, other firms gained a windfall so the overall effect was small. Although prices were quite volatile when the program initially started, for the remainder of the period that OTC NO<sub>x</sub> budget program was in force (2000-2002) average NO<sub>x</sub> allowances sold at prices slightly under the forecast of \$1,500 per ton. Firms used the market to work out their differences rather than challenge them in court, and regulators did not try to impose price caps or "safety valves" that would have set a ceiling on allowance prices and would have effectively allow the plants to exceed their emissions allowances in exchange for paying a fixed penalty.

## **4 SAFEGUARDS**

As the discussions above indicate, allowance price distortions could result from several sources the most important of which are mistakes by firms that have little in the way of expertise that could prepare them for emissions trading and risk aversion on the part of firms that are concerned about future access to allowances. Although less likely, prices could also be distorted by deliberate manipulation of firms and/or other allowance market participants that are seeking to profit by distorting allowance or product markets. Mistakes and risk aversion can be difficult to address in market design but are often less of an issue over time as firms gain experience in emissions trading.

By contrast, motives and opportunities for deliberate manipulation of a trading system are unlikely to diminish over time. Thus, elements need to be incorporated into the design of a trading system that address the potential for market manipulation. The following is a set of system design

options that can substantially eliminate the potential for market manipulation and other sources of allowance price distortions.

#### **4.1 Type of Auction**

Auctioning processes that are readily understood by all potential participants, easy for regulators to conduct, and generate results that can be announced quickly will reduce uncertainties in the market, create fewer potential distortions in spot markets, and address concerns of risk averse firms. Single round auctions offer the added benefit of discouraging collusion and uniform price auctions are better suited to aiding in price discovery and communicating the cost of carbon to all participants in carbon markets. However, uniform price auctions typically generate lower revenues than price discriminating auctions.

#### **4.2 Joint and Uniform vs. Individual Auctions**

An important issue in designing an allowance auction is whether individual states should hold separate auctions or if they should participate in a regional auction. A joint and uniform regional auction for allowances of a given vintage would be more cost-effective and efficient than each state creating a separate auction system. Most importantly, it would create a higher level of consistency across states and thus increase market stability. One argument against states holding individual auctions is that differences in auction design and implementation across states can lead to confusing and irrelevant differences in price signals. In addition, if individual states held separate auctions, states could be tempted to choose the timing of auctions, reserve prices, and other parameters in ways that favor them. Also, a regional system would help reduce and spread transaction and administrative costs. If individual states held multiple auctions for the same vintage of allowances, each state would have to set up the infrastructure and auction platform, which would both raise the administrative costs of making allowances available to the market and the transaction costs for firms seeking to acquire them.

#### **4.3 Participation in Auctions**

There is little evidence to support fears that some express about allowing non-covered entities to participate in allowance auctions. Outsider participation offers benefits in the form of increasing the potential for a robust market, and empirical evidence suggests little to no risk to entities that are covered by emission caps. Thus, there is no clear reason to exclude outsiders at the outset of the WCI trading system. That policy can be reviewed, of course, as the market is monitored on an ongoing basis.

#### **4.4 Quantity Limits**

Restricting the number of allowances that a single entity can purchase during any one auction might have negative implications for new firms that are attempting to enter an industry that is covered by emission caps. However, since WCI is planning to hold auctions at quarterly intervals and since new entrants will have access to allowances and offsets through the secondary market, limiting the proportion of allowances any one entity can purchase during a single auction will not impose an excess burden on participating firms and would be an effective means of protecting inexperienced participants from purchasing more allowances than they will need.

#### **4.5 Auction Rules**

In designing an auction, regulators need to consider a number of factors in addition to the type of auction that will be used. Specifically, requirements that ensure participants can and will take ownership of any allowances they successfully bid for during the auction are important, as are factors that will have an effect on the length of time between the opening of the auctioning process and the final reporting of results. From start to finish, any given auction needs to be completed quickly and efficiently so as to minimize the potential for disruptions in the spot market. Requiring lines of credits or other financial assurances from bidders, setting appropriate lot sizes for auctioned allowances, and keeping settlement periods as short as possible are all keys to successful auctions.

#### **4.6 Transparency**

As a rule, as the transparency of an emissions trading program increases, the greater the level of confidence the public, the entities covered by the emissions caps, and other stakeholders have regarding the environmental effectiveness and economic efficiency of the system. Thus, releasing information to the public about emission levels, compliance or non-compliance status, and allowance ownership and transactions by the firms that are covered by the trading system can be effective in building support for the scheme.

There might, however, be a disadvantage to releasing individual information on trading activity. Since emission levels are closely related to production levels in most industries, information about purchases of allowances will provide a signal as to how much each firm is producing. In an industry that is highly concentrated, this is the very type of information needed to enforce a cartel arrangement in a product market. Although it is more likely to be an issue for a national program than for a regional trading program, it would be wise to undertake some additional analysis to determine if there are industries within WCI that exhibit the conditions that are conducive to exploiting information on emissions trading activity to enforce a product market cartel. Releasing aggregate information on trading activity should be sufficient to ensure transparency while protecting the confidential business information of individuals.

#### **4.7 Offsets**

Allowing capped entities to use offsets for compliance purposes can contribute to lower costs for regulated firms, provide additional liquidity in the spot market for emission allowances, and serve as an effective means of achieving emission reductions in sectors that are not subject to caps under the trading system. Moreover, the potential for firms to acquire and use offsets will discourage entities from attempting to artificially inflate allowance prices for their individual gain.

#### **4.8 Oversight by WCI and the States**

A useful tool for promoting market integrity is a well-funded and vigilant oversight program. For a regional trading system such as WCI is planning, the most effective oversight authority will be one that is established at the regional level. Oversight at the regional level would be more cost-effective and efficient since it would require less financial resources for monitoring tasks. It would only require one repository for information and only one dataset for analyses. Monitoring is also important to building confidence in a trading system since the value of allowances will not erode due to illegal or unsanctioned activity. Monitoring should be an ongoing part of the administration of the program. If it appears as if there is collusion among bidders, states should be prepared to make adjustments to the program including modifying the auction design. The monitor can also look for imbalanced positions among participants, which is often a clear sign of market manipulation.

The WCI Partners plan to create a regional administrative organization that can monitor and report on allowance market activity. This market monitoring function should be separate from other state monitoring units such as the ISO's that monitor electricity markets. Nonetheless, the WCI states should coordinate with interested federal and state agencies in the design of monitoring criteria and information sharing in developing a carbon allowance specific monitoring effort. Existing market monitoring activities by federal and state agencies and provincial agencies should be examined by the WCI Partners to ensure that the appropriate criteria are used for detecting market manipulation and for sharing information regarding the performance of the allowance market and the detection of attempts to manipulate price. WCI Partners could coordinate with entities such as the Federal Energy Regulatory Commission, the US. EPA, the Independent System Operators and the Commodity Futures Trading Commission and perhaps the independent market monitor that RGGI has hired. However, WCI needs its own monitoring organization and should not rely exclusively on regulatory capacity of other federal and/or state agencies to police trading within the WCI.

A WCI wide monitoring agency will provide the regional authority with a broader perspective on activities that could be influencing the trading system and/or have the potential to make the program susceptible to manipulation, such as strategic purchases of allowances in multiple states. Information and resources that would need to be available to ensure an effective WCI oversight authority include access to all data on purchases and sales of emission allowances and offsets, data on emission caps imposed on regulated firms, the line of business of any outsiders that participated in spot and auction markets, and complete information on any derivative instruments and transactions in derivative instruments that are based on allowances created for WCI. To further decrease the likelihood of deliberate manipulation of allowance markets, the oversight authority might also be endowed with the authority to void suspicious transactions in allowances. A regional monitor can ensure consistency among states even if individual states and provinces are still responsible for the enforcement of violations. If a regional system is implemented, individual states will have to coordinate on the division of costs and commitments to maintain the budget such that monitoring efforts are not compromised. One option is to use a portion of the proceeds from allowance auctions to cover market monitoring and administrative costs.

Although creating a regional monitor will be the most cost-effective approach to providing oversight to carbon and related markets in WCI, all of the functions mentioned above could be carried out by each of the individual states. The total cost, however, would be considerably higher and especially in the case of actions such as voiding suspicious transactions, coordination among the states would be needed as would some initial agreement on what constitutes a suspicious transaction.

## **APPENDIX A: TYPES OF AUCTIONS**

### **Single-Round, Uniform-Price Auction: Treasury Bill Auctions**

To finance the public debt, the U.S. Treasury sells bills, notes, bonds, and Treasury Inflation-Protected Securities (TIPS) to institutional and individual investors through public auctions. Treasury bills are short-term securities maturing in one year or less.<sup>5</sup> The U.S. Treasury uses a single-round, uniform-price auction process to sell these securities and determine their rate or yield. Through the auction, bills are sold at a discount from their face value. When a bill matures, the investor receives the face value. The amount of interest earned is determined by the difference between the purchase price and the face value. The U.S. Treasury conducts more than 200 public auctions a year. For example, the 4-week bills are offered each week. Generally, the offering is announced on Monday, the bills are auctioned the following Tuesday, and they are issued on the Thursday following the auction. When participating in an auction, there are two bidding options—competitive and noncompetitive.

- Competitive bidding is limited to 35% of the issue amount for each bidder, and a bidder specifies the rate or yield that is acceptable.
- Noncompetitive bidding is limited to purchases of \$5 million for U.S. Treasury bills, notes, bonds, and TIPS. With a noncompetitive bid, a bidder agrees to accept the rate or yield determined at auction.
- Bidding limits apply cumulatively to all methods that are used for bidding in a single auction.

At the close of an auction, Treasury accepts all noncompetitive bids that comply with the auction rules and then accepts competitive bids in ascending order in terms of their yields until the quantity of accepted bids reaches the offering amount. All bidders will receive the same rate or yield at the highest accepted bid.

### **Multi-Round, Uniform-Price Auction: Lithuania EU ETS Phase I Auction**

On September 10, 2007, Lithuania auctioned some EU ETS Phase I allowances using a multi-round, uniform-price auction. The bidding period for the third party run Lithuanian auction lasted for one hour, in which bidders were free to modify their bids. However, after that hour, the submitted bids were not allowed to be withdrawn or changed. The bidding was blind in that the other submitted bids were not visible to other bidders. Each bid contained a price and a volume of allowances the entity was willing to purchase at or below that price. The bids were then placed in descending order and the volumes of the bids are summed until the total bid volume equaled the total number of allowances to be sold. The lowest successful bid sets the clearing price, which is the price all successful bidders pay in this uniform pricing format. This auction cleared 552,000 EU allowances (EUA) at a price of €0.06 per tonne.<sup>6</sup>

### **Single-Round, Discriminatory-Price Auction: SO<sub>2</sub> Auctions**

The Acid Rain Program (ARP) was implemented by the EPA in two Phases. Phase I (1995–2000) included coal-fired energy generators with a capacity greater than 100 MW. Phase II (since 2000) included all coal, oil, and gas generators with a capacity greater than 25 MW. Phase I impacted approximately 431 boilers and Phase II affected 2,685 boilers. Each participant is

<sup>5</sup> <http://www.treasurydirect.gov/instit/marketable/tbills/tbills.htm>

<sup>6</sup> <http://www.euets.com/index.php?page=news&newsid=60&l=1>

allocated 97.2 percent of its emissions permits. The remaining 2.8 percent was withheld and auctioned in a revenue-neutral manner (i.e., no revenue is generated for the government) to activate trading and ensure accessibility to new entrants. During Phase I, when the allocated allowances totaled 5.7 million allowances annually, 150,000 allowances were withheld every year for auctions. During Phase II, when allowance allocations total 8.95 million allowances annually, 250,000 allowances were withheld annually for auctions.

The annual auctions are divided into two segments: (1) a spot allowance auction in which allowances are sold that can be used in that same year for compliance purposes, and (2) an advance auction for the sale of allowances that will become usable for compliance 7 years after the transaction date, although they can be traded earlier.<sup>7</sup> The auction is open to the public, as both buyers and sellers, with no limits on volume.

The auction mechanism is sealed-bid (single-round) and the pricing is discriminatory. This means that the bidders can submit multiple offers to purchase allowances with bids at different prices. The auction is “discriminatory” because the price paid varies among bidders in relation to their bid price. To participate, bidders must send sealed offers containing information on the number and type (spot or advance) of allowances desired and the purchase price to EPA, no later than 3 business days prior to the auctions. Each bid must also include a wire transfer, certified check, or letter of credit for the total bid cost. The reserve asking price for withheld allowances is set to zero by the EPA.

### **Multi-round, Discriminatory-Price Auction: Dutch Flower Auction**

The Dutch flower auctions are renowned throughout the world for their pricing and distribution of flowers and plants. This multi-round (descending) discriminatory-price auction starts with a high provisional price, which falls by predetermined increments. The auction is discriminatory in price because in each round the bidder can “lock in” some purchases at the current provisional price (analogous to a “buy now” provision in an online auction at eBay) and/or the bidder can wait for the price to fall. The auction stops when the number of allowances locked in is greater than or equal to quantify, with ties in the final round decided by the time at which a bid was entered, again providing an incentive for bidders to act early in each round.

In 2004, the four main flower auctions in the Netherlands generated sales of almost 3.6 billion euros. The function of the Dutch flower auction is to concentrate offer and demand since everyday, approximately 10,000 flower breeders deliver their products to the auction, and approximately 5,000 buyers make their choice. Handling approximately 100,000 transactions every day, the auctions distribute a vast, homogeneous offer among a large number of different parties. The auction takes place by counting down from highest price to lowest price. The buyer stops the clock by pressing a button. If the buyer is the first to press the button, the buyer then purchases the flowers or plants being auctioned.<sup>8</sup> Each day, there are approximately 5,000 buyers. For producers, the auction guarantees their daily sales and payment. The auction also offers a transparent market and an objective operation of the price mechanism. A minimum price is set for each product. If a batch is not sold, it is withdrawn (and destroyed). This leads to a stable pricing system, which in turn promotes a stable offer and stable demand.<sup>9</sup>

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<sup>7</sup> <http://www.epa.gov/airmarkets/trading/factsheet-auction.html>

<sup>8</sup> [http://www.flowercouncil.org/us/news/08US\\_auctionfacts.asp](http://www.flowercouncil.org/us/news/08US_auctionfacts.asp)

<sup>9</sup> <http://www.vbn.nl/en/overvbn/veilingen/index.asp>

## **APPENDIX B: MARKET OVERSIGHT OF EMISSIONS TRADING**

This appendix draws some lessons in market oversight. Experiences in the U.S. Title IV sulfur dioxide trading program, the European carbon allowance market and the emerging carbon market by the ten Regional Greenhouse Gas Initiative (RGGI) states provide insights into the kind of market oversight that should be exercised in WCI and all emission trading programs. Regulation of any kind of emissions trading needs to consider two possible types of market manipulation: fraud by traders or intermediaries against other investors as well as sustained price manipulation.

There are many types of emissions trading that can occur and each situation covers different markets and players and well as roles of different market monitors. Allowances can be bought during the primary auction as well as bought and sold in the secondary market. Trading occurs in the form of bilateral agreements and on over-the counter (OTC) markets. In addition, emissions derivative transactions (e.g. futures, forwards, options, swaps, spreads, caps, and floors) have also developed as the emissions markets become more sophisticated. Not only do these different types of market mechanisms facilitate efficient abatement strategies, they also demonstrate that efficient primary and secondary market mechanisms have developed and there are some good insights and lessons learned from the oversight of the existing cap and trade programs.

### **General Lessons for Emissions Markets from Commodity Markets**

While an emissions market is similar to other commodity markets, there are several key differences in the emissions market as compared with other commodities markets. An emissions market is a politically generated and managed market as opposed to a physical commodity such as electricity or natural gas. Emissions allowances are intangible rights or authorizations and while they can be bought and sold like other commodities, they exist only as a book entry in an emissions account. Thus, the emissions market is defined by the parameters of the policy mechanisms that are put in place such as auction rules, reserve prices and unlimited banking, and there is a compliance aspect to the emissions market that other commodities do not face. Transparency is the foundation for building market confidence and as a politically-generated market, it is very important to have information about the amount and quality of emissions quantities released in a timely and orderly manner to prevent market manipulation. At the same time, privacy and confidential business information should be protected. Therefore, government should typically release information from commodity markets at aggregate levels.

Theoretically, as with other commodities, allowance prices could be subject to the risk of a market being cornered or squeezed by a manipulator. To corner the market, a manipulator would amass a large inventory of allowances while simultaneously taking futures or forward positions that required others to make delivery to it. When a squeeze is successful, a trader with delivery obligations would be forced to buy from the manipulator, who can dictate the price, and then sell those same allowances back to manipulator at the lower prices specified in the futures and forward contracts. While a number of theoretical studies have raised the possibility of price manipulation by a dominant firm or by a few large firms acting in collusion, there has not been any direct evidence that this has occurred in emissions markets.

In addition, in all commodity markets, futures exchanges and clearing houses have strong incentives to prevent manipulation—since futures trading is a “zero-sum” game. Clearing houses, which guarantee payments on all contracts, also face the risk that a squeeze or concern may cause many traders to default on their obligation. Unlike other commodity markets, the compliance market also allows government agencies to access large amounts of price-sensitive data, and any attempts at market manipulation can be dealt with quickly.



## **Market Oversight in the U.S. Title IV Sulfur Dioxide Program**

The U.S. Title IV sulfur dioxide (SO<sub>2</sub>) program has had a long history of emissions trading and numerous market platforms and government oversight have developed. The Title IV program involves up to 3,000 new and existing electric generating facilities that contribute to two-thirds of the country's SO<sub>2</sub> emissions and one-third of its nitrogen oxide (NO<sub>x</sub>) emissions, the two primary precursors of acid rain. While the primary auction is quite small (only 2.8% of the SO<sub>2</sub> emission allowances are auctioned annually), it provides a strong price signal and ensures liquidity in the SO<sub>2</sub> market for new entrants. In addition, trading in the secondary markets has increased every year as the market gets more robust, and over the counter markets account for virtually all of the SO<sub>2</sub> allowance trading volume.

There are two important trends in Title IV trading that are likely to emerge in a carbon market. First, there is a trend towards more diverse, non-traditional participants, such as financial institutions, participating in the allowance markets. The motivations of these participants might be equally diverse, including facilitating projects involving the needs for allowances, portfolio balancing, and profits earned through intermediary fees or proprietary trading. In addition, there is a trend in the Title IV market towards using financial instruments such as derivative transactions to manage allowance price risk.

As one of the first cap-and-trade programs, the SO<sub>2</sub> market has been monitored for years to ensure that it is functioning well and not subject to manipulation. It is EPA's responsibility to administer the trading, banking, and auctioning of allowances and to monitor the performance of the emissions market. EPA also monitors the secondary market and conducts ongoing analysis using a variety of indicators. EPA aggregates allowance holdings by parent company or holding company, and looks for concentrations of market power. EPA monitors the activity of all participants, including brokerage firms, and other non-emitting entities such as hedge funds by looking at the trade logs weekly. The EPA's accounting software, known as the Allowance Tracking System (ATS), is the backbone of both the SO<sub>2</sub> and NO<sub>x</sub> markets. The ATS does not require the disclosure of prices at which trades occur, but it does enable and require the transfer of allowances among authorized accounts. In addition, there are market indexes that are maintained by various entities that are publicly available and are monitored by the EPA.

In addition to EPA's monitoring, the Commodity Exchange Act provides the basis for federal regulation of "derivative" transactions in contracts based on commodity prices. Pursuant to the act, the Commodity Futures Trading Commission (CFTC) regulates the New York Mercantile Exchange (NYMEX) and the Chicago Climate Futures Exchange (CCFE). These are the two futures exchanges that deal in SO<sub>2</sub> and NO<sub>x</sub> allowances and RGGI allowances (see below for more details on RGGI). Allowances are regulated by the CFTC as exempt commodities under the Commodity Futures Modernization Act of 2000. Although the primary realm of authority for the CFTC is the futures market, the agency can "reach back" into the over-the-counter cash market when there is evidence of market manipulation where the cash market transactions affect the regulated futures market.

The Federal Energy Regulatory Commission also provides oversight to all markets providing components that contribute to the delivery of electricity services and activities in those markets. It also monitors the behavior of parties in the electricity markets and various input markets, including emissions markets, on a daily basis.

All three of these organizations (EPA, CFTC and FERC) monitor and report on the competitive structure, performance, and economic efficiency of the SO<sub>2</sub> market, as well as the conduct of market parties, including any attempt to exercise market power or restrict competition. There has been no indication that there has been market manipulation of allowance prices in either the primary auction or in the secondary markets including the allowance related derivative market.



## Market Oversight in the Regional Greenhouse Gas Initiative (RGGI)

While the Regional Greenhouse Gas Initiative (RGGI) will not officially start until January 1, 2009, there are some important lessons learned from the development of RGGI, the start of the secondary markets and from the first RGGI auction in September 2008. While the EPA ATS tracking system did not require the disclosure of trades, the RGGI states have required that the authorized account representatives disclose the “beneficial ownership” of any allowance holdings as an additional measure to prevent manipulation. This means, that every participant must disclose the party sponsoring or benefiting from the agent’s activities in the allowance market if it was other than themselves or their immediate employer. This information will allow RGGI and interested third parties, including government agencies, to identify allowance holdings that appear in excess of compliance obligations and to use this information as a potential trigger for further investigations.

In addition, the RGGI states hired an independent market monitor to assess the conduct of the market participants in both the primary and secondary markets so that they could identify any indications of market manipulation or collusion as well as monitor the administration of the primary auction. Shortly after the first RGGI auction in September 2008, the independent market monitor, Potomac Economics, released its evaluation of the first quarterly auction. As part of the market transparency, the market monitor released a post-auction data report which contains aggregate auction information including, the dispersion of projected demand of allowances, the dispersion of bids, a summary of purchased allowances by type of bidder, a list showing amounts of allowances awarded to bidders where the names are redacted and a summary of the bid prices, showing the minimum, maximum, average and clearing price as well as the names of the potential bidders. The market monitor found that there was no material evidence of collusion or manipulation by bidders and that the vast majority of the bids were submitted in line with competitive expectations and that the auction was conducted in a fair and transparent manner.<sup>10</sup>

These RGGI market monitoring provisions are in addition to the oversight and monitoring role that the CFTC is already providing (and that the CFTC would naturally provide to a future WCI GHG market). In the summer of 2008, NYMEX<sup>11</sup> and CCFE<sup>12</sup> launched a CFTC Designated Contract Market of RGGI futures and Options contracts, illustrating what could be labeled a “natural evolution” of this type of market. There is a natural demand for futures markets for any product for which there is a pool of buyers and sellers that would like to manage the risks of large price fluctuations. NYMEX and CCFE have responded as private organizations, and their activities naturally (and legally) come under the oversight of the CFTC.

While volumes on the exchanges are still light, as expected, the prices and volumes increased leading up to the first auction and decreased slightly once the auction price became known. Following the release of the market monitor’s report which gave more details on the results of the

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<sup>10</sup> Memorandum from David Patton and Pallas LeeVanSchaick, Pomomac Economics to RGGI Inc and the RGGI Participating States, re: Allowance Auction on September 25, 2008, [http://www.rggi.org/docs/Auction\\_1\\_PostSettlement\\_Report\\_from\\_Market\\_Monitor.pdf](http://www.rggi.org/docs/Auction_1_PostSettlement_Report_from_Market_Monitor.pdf)

<sup>11</sup> With NYMEX, the new futures contract, with commodity code RJ, will be physically delivered to the RGGI CO2 Allowance Trading System (RGGI-COATS). It will be available for trading on the CME Globex® electronic trading platform. The RGGI options contract, with contract code OR, will be an American-style option that exercises into the underlying RGGI futures contract. The contract will trade on the NYMEX trading floor. Additionally, off-exchange options transactions can be submitted for clearing via NYMEX ClearPort. The listing of these products on NYMEX is a Green Exchange initiative, which will provide a trading platform for environmental commodities. Source: NYMEX to Launch Regional Greenhouse Gas Initiative (RGGI) CO2 Allowance Futures, Options Contracts as Part of its Green Exchange Venture

[http://new.evomarkets.com/pdf\\_documents/Green%20Exchange%20Launches%20RGGI%20Contract.pdf](http://new.evomarkets.com/pdf_documents/Green%20Exchange%20Launches%20RGGI%20Contract.pdf)

<sup>12</sup> <http://carbonfinancereport.com/news/chicago-climate-futures-exchange-rggi-futures-and-options-contracts/>

first auction, prices and volumes increased as the market responded favorably to more information.<sup>13</sup> While prices and volumes continue to fluctuate based on various carbon market indicators, the secondary market is providing good price signals as well as indicating that there has not been market manipulation.

Finally, the FERC Oversight Division and the three Independent System Operators (ISOs) serving the electricity industry in the ten RGGI states will also monitor the competitive structure, performance, and economic efficiency of the electricity market as well as the conduct of market parties, including any attempt to exercise market power or restrict competition. This FERC division will play the same role in any WCI carbon market that emerges, and it is likely that electricity operators such as California's ISO will also help monitor the WCI program.

### **Market Oversight in the European Union Emissions Trading Scheme (EU ETS)**

As has been the case with allowance markets in the U.S., the volume of trading in the EU ETS has grown steadily as the program was implemented. Trading primarily occurs through bilateral agreements and over-the-counter markets. Both types of transactions are essentially unregulated, other than an obligation to report all transactions to the national registry (Jickling and Parker, 2008). An important feature of the ETS market that distinguishes it from U.S. allowance markets is the importance of organized exchanges. While over-the-counter markets remain the dominant form of trading, trading on organized exchanges appeared rapidly and now about one-third of trades take place on exchanges (Ellerman and Joskow, 2008). The London Exchange (ECX) is now by far the largest single platform for trading and it accounts for about 75 percent of the exchange volume. The main trading instruments in the EU allowance market are forward and futures contracts for delivery in December of the specified year.<sup>14</sup> The rapid growth of the allowance trading volumes suggest that investors do not view the market as being rigged against them or that they are subject to manipulation by insiders.

A lesson learned from the EU ETS is that allowance prices are linked to the price of other energy commodities such as oil and natural gas. For example, when natural gas becomes more expensive relative to oil, industrial users may switch to oil, which has a higher carbon content, thus creating an increased demand for allowances. It should be noted that so far, EU regulators have not brought any enforcement actions based on manipulation of emissions prices (Jickling and Parker, 2008).

The European Union Allowance (EUA) market has exhibited the same characteristics as markets for tradable permits in the U.S., such as those for SO<sub>2</sub> and NO<sub>x</sub>. Notably, a market developed relatively quickly without special effort on the part of the government beyond creating the cap, distributing the allowances, and enforcing compliance. Allowance traders come under regulation when they engage in financial practices that are regulated regardless of the nature of the underlying interest or instrument (as occurs in the U.S. as well). While national regulations vary within the EU, in general, the exchanges where emissions and emissions derivatives are traded are subject to a regulatory scheme that is similar to the regulation of the futures exchanges in the U.S. by the CFTC. For instance, the exchanges must satisfy a number of conditions of registration, which include market surveillance to deter fraud and manipulation, and varies reporting

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<sup>13</sup> Point Carbon News: Carbon Market North America, October 24, 2008, <http://www.pointcarbon.com/news/cmna/1.992123>

<sup>14</sup> The December maturity for each year is a convention that conforms to the reconciliation procedures in the EU ETS. Companies must surrender allowances equal to their emissions by the end of April in the following year. Thus, a firm that needs to purchase EUAs to cover emissions or that wishes to hedge its exposure for current production can either purchase the required EUAs in the spot market or purchase a futures contract corresponding to the compliance year for which allowances will be surrendered (Ellerman and Joskow, 2008).

requirements which include the publication of trade and price data. In all cases, there has been no lack of intermediaries to facilitate trading among parties with either long or short positions, and to create a single price at any one moment in time for trading instruments with similar attributes.

The lack of EU-wide regulatory oversight bodies has triggered general discussions on whether such bodies could give investors more confidence in the European carbon market as well as the price signals that it provides. In particular, analysis performed within the Center for European Reform proposed to establish two new, fully independent institutions as the corner stones of the future EU ETS: a European Environmental Board and a European Carbon Market Authority.<sup>15</sup>

The first institution, the European Environmental Board, could either be part of a significantly strengthened European Environmental Agency or be a new freestanding agency. Based on an overall EU emission target stretching out to 2050 and agreed to by the European Parliament and Council, this new institution would monitor and verify emissions; allocate emission permits which are not auctioned (e.g. to industry exposed to international competition); and organize auctions.

The second institution could be a fully independent EU-wide regulatory body to oversee the carbon market. Similar to existing financial market authorities this new European Carbon Market Authority would ensure that the carbon market functions efficiently and transparently. To this end, it would aim to monitor market transactions and uncover potential price manipulations in order to secure a liquid and transparent carbon market and prevent excessive market volatility.

## Conclusion

The experience of these three emissions trading programs (SO<sub>2</sub> trading, RGGI and the EU-ETS) demonstrate that the emissions trading markets are not prone to manipulation. In addition, there are numerous agencies that help to detect and prevent market manipulation, and they would play similar oversight roles in the WCI carbon market. Should manipulation occur, they have a variety of tools to address the manipulation. For instance, the Securities and Exchange Commission (SEC) and the CFTC have extensive experience with numerous programs designed to prevent and punish fraud which take place in a self-regulatory framework and regulated exchanges are required to establish and enforce rules to promote fair trading. In addition to federal statutes and regulations and the rules of self-regulating securities and futures exchanges, state laws provide protection against illegal trading activities because transactions between customers and brokers, investment advisors, and other intermediaries are regulated at the state level to prevent customers from being taken advantage of since they have less knowledge of current market conditions.<sup>16</sup> The WCI should consider adopting the “beneficial ownership” of allowance holdings that RGGI has recently adopted as well as hiring an outside market monitor to provide

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<sup>15</sup> Based on a discussion in: Centre for European Reform (2007). *How to make EU Emissions Trading a Success*.

<sup>16</sup> Every state has its own securities laws—commonly known as “Blue Sky Laws”—that are designed to protect investors against fraudulent sales practices and activities. While these laws can vary from state to state, most states laws typically require companies making small offerings of securities to register their offerings before they can be sold in a particular state. The laws also license brokerage firms, their brokers, and investment adviser representatives. Each state’s blue sky law is administered by its appropriate regulatory agency, and most also provide private causes of action for private investors who have been injured by securities fraud. Historically, the federal securities laws and the state blue sky laws complemented and often duplicated one another. Much of the duplication, especially with regards to registration of securities and the regulation of brokers and advisors, was largely preempted by the SEC with the National Securities Markets Improvement Act of 1996 (NSMIA). This act, however, left some regulation of investment advisors and much of the fraud litigation under state jurisdiction. In 1998, state law securities fraud claims were expressly preempted by the Securities Litigation Uniform Standards Act from being raised in lawsuits that were effectively class actions by investors, even if not filed as class actions. For specific information of each state’s Blue Sky laws see . <http://www.seclinks.com/id63.html>

monitoring and oversight of the WCI program to ensure that all aspects of emissions trading are monitored. Transparency ensures that the availability of timely and affordable price information is available but there are limits to transparency; beyond a point, it becomes very expensive and may harm the market if confidential information is released. WCI should also consider what to make public and that it be done on a coordinated basis.

As the trend with the other emissions trading program has demonstrated, the WCI cap-and-trade program is likely to see a diverse group of non-traditional participants, such as financial institutions participating in auctions and the secondary market. In addition, it appears likely that the market participants will use a variety of financial instruments to manage allowance price risk as a hedge against price uncertainty. With proper oversight and regulatory authority to prevent, detect or punish any allowance price manipulation some of which already exists at the federal level, it is unlikely that the allowance market will be able to be manipulated in any serious manner. As in all markets, confidence in the market depends on investors believing that prices are determined fairly, in response to real economic factors, and are not manipulated. Providing that oversight—and thus assurance—in the market is a major function of the regulators. Thus it is important that government provide reliable and transparent price and emissions information at the appropriate aggregate level. This will not only guide firms in their investment decisions, but it will also help foster liquid secondary markets, which in turn can make prices more efficient and thus reduces the likelihood of market manipulation.

## **APPENDIX C: GLOSSARY OF SELECTED FINANCIAL TERMS**

This appendix provides a glossary of selected financial terms mentioned in the body of the paper. The definitions are from entries in [www.wikipedia.org](http://www.wikipedia.org), with minor adaptation.

**Derivatives:** financial instruments whose values depend on the value of other underlying financial instruments. The main types of derivatives are futures, forwards, options, and swaps.

The main use of derivatives is to reduce risk for one party. The diverse range of potential underlying assets and pay-off alternatives leads to a wide range of derivatives contracts available to be traded in the market. There are three major classes of derivatives:

- **Futures/Forwards:** contracts to buy or sell an asset at a specified future date.
- **Options:** contracts that give a holder the right to buy or sell an asset at a specified future date.
- **Swaps:** in which two parties agree to exchange cash flows or returns.

**Credit Default Swap (CDS):** a swap contract in which the buyer of the CDS makes a series of payments to the seller and, in exchange, receives a payoff if a credit instrument (typically a bond or loan) goes into default or on the occurrence of a specified credit event (for example bankruptcy or restructuring). CDSs can be bought by any (relatively sophisticated) investor; it is not necessary for the buyer to own the underlying credit instrument.

CDSs have been compared to insurance, because the buyer makes a “premium-like” payment, and in return receives a sum of money if a specified event occurs. However, this is a slightly misleading comparison because the buyer of a CDS does not need to own the underlying security; in fact the buyer does not even have to suffer a loss from the default event.

**Forward contract:** an agreement between two parties to buy or sell an asset at a specified point of time in the future. The price of the underlying instrument, in whatever form, is paid before control of the instrument changes. This is one of the many forms of buy/sell orders where the time of trade is not the time where the securities themselves are exchanged.

The forward price of such a contract is commonly contrasted with the spot price, which is the price at which the asset changes hands on the spot date. The difference between the spot and the forward price is the forward premium or forward discount, generally considered in the form of a profit (or loss) by the purchasing party.

This process is used in financial operations to hedge risk, as a means of speculation, or to allow a party to take advantage of a quality of the underlying instrument which is time-sensitive. A closely related contract is a futures contract, but they differ in certain respects (see **Futures vs. Forwards** below).

**Futures contract:** a standardized contract, traded on a futures exchange, to buy or sell a certain underlying instrument at a certain date in the future, at a specified price. The future date is called the delivery date or final settlement date. The pre-set price is called the futures price. The price of the underlying asset on the delivery date is called the settlement price.

A futures contract gives the holder the obligation to buy or sell, which differs from an options contract, which gives the holder the right, but not the obligation. In other words, the owner of an options contract may exercise the contract, but both parties of a "futures contract" must fulfill the

contract on the settlement date. The seller delivers the underlier to the buyer, or, if it is a cash-settled futures, then cash is transferred from the futures trader who sustained a loss to the one who made a profit. To exit the commitment prior to the settlement date, the holder of a futures position has to offset his/her position by either selling a long position or buying back a short position, effectively closing out the futures position and its contract obligations

Futures contracts, or simply futures, are exchange-traded derivatives. The exchange's clearinghouse acts as counterparty on all contracts, sets margin requirements, and crucially also provides a mechanism for settlement.

**Futures vs. Forwards:** While futures and forward contracts are both contracts to deliver an asset on a future date at a prearranged price, they are different in two main respects:

- Futures are exchange-traded, while forwards are traded over-the-counter. Thus futures are standardized and face an exchange, while forwards are customized and face a non-exchange counterparty.
- Futures are margined, while forwards are not. Thus futures have significantly less credit risk, and have different funding.

**Options:** financial instruments that convey the right, but not the obligation, to engage in a future transaction on some underlying security, or in a futures contract. In other words, the holder does not have to exercise this right, unlike a forward or future. For example, buying a call option provides the right to buy a specified quantity of a security at a set strike price at some time on or before expiration, while buying a put option provides the right to sell. Upon the option holder's choice to exercise the option, the party who sold, or wrote, the option must fulfill the terms of the contract.

The theoretical value of an option can be determined by a variety of techniques. These models, which are developed by quantitative analysts, can also predict how the value of the option will change in the face of changing conditions. Hence, the risks associated with trading and owning options can be understood and managed with some degree of precision compared to some other investments.

Exchange-traded options form an important class of options which have standardized contract features and trade on public exchanges, facilitating trading among independent parties. Over-the-counter options are traded between private parties (often well-capitalized institutions) that have negotiated separate trading and clearing arrangements with each other. Employee stock options are another important class of options, particularly in the U.S. They are awarded by a company to their employees as a form of incentive compensation.

Other types of options exist in many financial contracts, for example real estate options are often used to assemble large parcels of land, and prepayment options are usually included in mortgage loans. However, many of the valuation and risk management principles apply across all financial options.

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